The JOURNAL OF ELECTRICITY
POWER AND GAS
WITH WHICH IS INCORPORATED
The Engineers' Architects' and Builders' News

PUBLISHED WEEKLY

By the Technical Publishing Company, Atlas Building, 604 Mission Street, San Francisco Cal.
Entered as second-class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the Act of Congress March 3, 1879.

Vol. XVIII No. 22 San Francisco, Cal., June 1, 1907. Yearly subscription $2.50 Single copies 10 cents Back numbers prior to current month 25 cents.

OKONITE WIRE

The Standard for Rubber Insulation

Okonite Tape, Manson Tape,
Candee Weather-proof Wire,
Candee (Patented) Potheads.

THE OKONITE COMPANY, 253 BROADWAY, N. Y.

STANDARD UNDERGROUND CABLE CO.

MANUFACTURERS OF

BARE AND INSULATED WIRES AND CABLES

CHICAGO PITTSBURG PHILADELPHIA ATLANTA
NEW YORK BOSTON ST. LOUIS SAN FRANCISCO
LOS ANGELES OAKLAND SEATTLE

PACIFIC COAST DEPT. A. B. SAURMAN Pacific Coast Mgr. BACON BLOCK, OAKLAND, CAL.

Meese & Gottfried Company

19th and Harrison Sts., SAN FRANCISCO

Power Transmitting Machinery

Of all description. We have a larger stock of Shafting, Hangers, Boxes, Pulleys, etc., than ever.

Seattle *San Francisco* *Los Angeles*

VULCAN

Refrigerating and Ice Making Machinery

Manufactured by

VULCAN IRON WORKS

OFFICE: 702 ATLAS BLD'G. 604 MISSION STREET WORKS: FRANCISCO AND KEARNY STS.

San Francisco, California.

INDIANA RUBBER AND INSULATED WIRE CO.

MANUFACTURERS OF

PARANITE AND PEERLESS RUBBER COVERED WIRES AND CABLES

Underground, Aerial, Submarine and Inside Use
TELEPHONE, TELEGRAPH AND FIRE ALARM CABLES

All Wires are Tested at Factory JONESBORO, IND.

ELECTRIC APPLIANCE CO.

315 Main St., San Francisco Pacific Coast Agents

San Francisco Los Angeles Oakland

HENSHAW, BULKLEY & CO.

AMES ENGINES AND BOILERS

219-221 Spear St. San Francisco, Cal.

California Incandescent Lamp Co.

Have Reopened at

No. 56 and 60 NATOMA ST.

SAN FRANCISCO

The National Conduit & Cable Co.

Manufacturers of

TROLLEY WIRE
BARE COPPER WIRE AND CABLES
WEATHER-PROOF WIRES AND CABLES
PAPER-INSULATED CABLES
FOR TELEPHONE, TELEGRAPH AND POWER

703 MONADNOCK BUILDING, SAN FRANCISCO

C. H. PENNOYER, PACIFIC COAST MANAGER

BROOKS-FOLLIS ELECTRIC CORP.

Electrical Supplies of all Kinds in Stock

214 FIRST STREET, Cor. Tehama SAN FRANCISCO

OAKLAND, 563 13th Street

PACIFIC METER CO.

MANUFACTURERS OF

WET AND DRY GAS METERS, STATION METERS, PROVERS, GAUGES, ETC.

917 AND 918 MONADNOCK BUILDING, SAN FRANCISCO, CAL.

VAN EMON ELEVATOR CO.

MANUFACTURERS OF .... HIGH-GRADE ELEVATORS

R. J. DAVIS, President
B. C. VAN EMON, Vice-President and Manager
H. B. RATHBONE, Secretary and Treasurer

NOT IN THE ELEVATOR TRUST

DIRECTORS
LOUIS F. MONTEAGLE W. P. PLUMMER
GEO. M. PINCKARD R. S. HUNKINS

OFFICE AND CONSTRUCTION DEPARTMENT
52 - 54 NATOMA STREET, SAN FRANCISCO

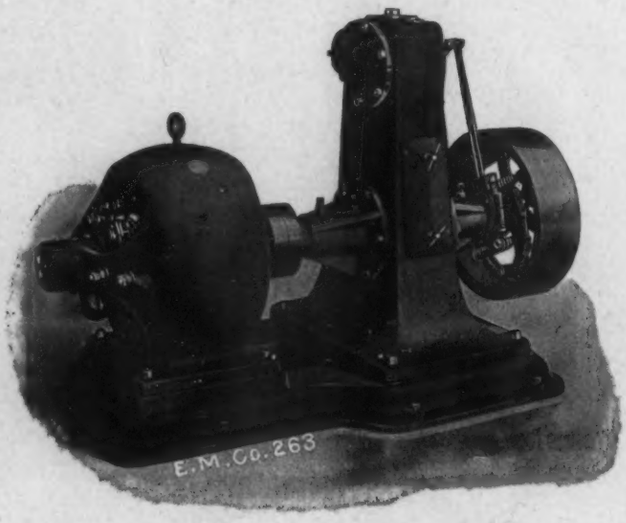
FACTORY AND FOUNDRY
WEST BERKELEY, CAL. (32,000 sq.ft.)

Standard Electrical Works

Pacific Coast Selling Agents

Electric Machinery Company

Generators and Motors



MULTIPOLAR D. C. GENERATORS
FOR
DIRECT CONNECTION TO HIGH SPEED ENGINE
1½ TO 15 KILOWATT

Let Us Figure on Your Requirements

Everything Electrical

San Francisco Delivery

Standard Electrical Works

121 New Montgomery, San Francisco, Cal.

THE

Journal of Electricity, Power and Gas

WITH WHICH IS INCORPORATED

The Engineers', Architects' and Builders' News

VOLUME XVIII. SAN FRANCISCO, CAL., JUNE 1, 1907 No. 22

Kern River Station No. 1 of the Los Angeles Edison Electric Company

Probably the most interesting and complete hydro-electric plant on the Pacific Coast is the new installation of The Edison Electric Company, of Los Angeles, known as Kern River Station No. 1. This plant, which has just been put in operation, will develop sufficient power to treble the capacity of The Edison Electric Company, the full load output of this plant, 40,000 horsepower, being more than twice that of all of the other plants combined operated under the management of The Edison Electric Company. The plant is located almost at the head waters of the Kern River. The hydraulic development includes a water conduit more than 12 miles in length, which makes available an effective head of nearly 1,000 feet. The length of transmission to Los Angeles is 117 miles, and the pressure used is 75,000 volts. We are able in this issue to give the first portion of a complete description of this plant, the article being especially prepared to show the character of the hydraulic development which is in many respects different from that of any other similar plant.

Water is diverted from the Kern River about one-half mile below Democrat Springs, in Kern County. From the diversion dam, the water is conveyed in a conduit, which consists principally of tunnels through the mountains in a southerly direction to a point nearly 1,000 feet above the river on the mountain side opposite the intake of the Bakersfield Power, Transit and Light Company. At this point has been constructed a forebay from which the force main incline

VIEW OF POWER HOUSE WITH WATER COMING DOWN SPILLWAY ON LEFT, ALSO SHOWING POSITION OF BRANCH PIPES COMING FROM FORCE TUNNEL AND GATES

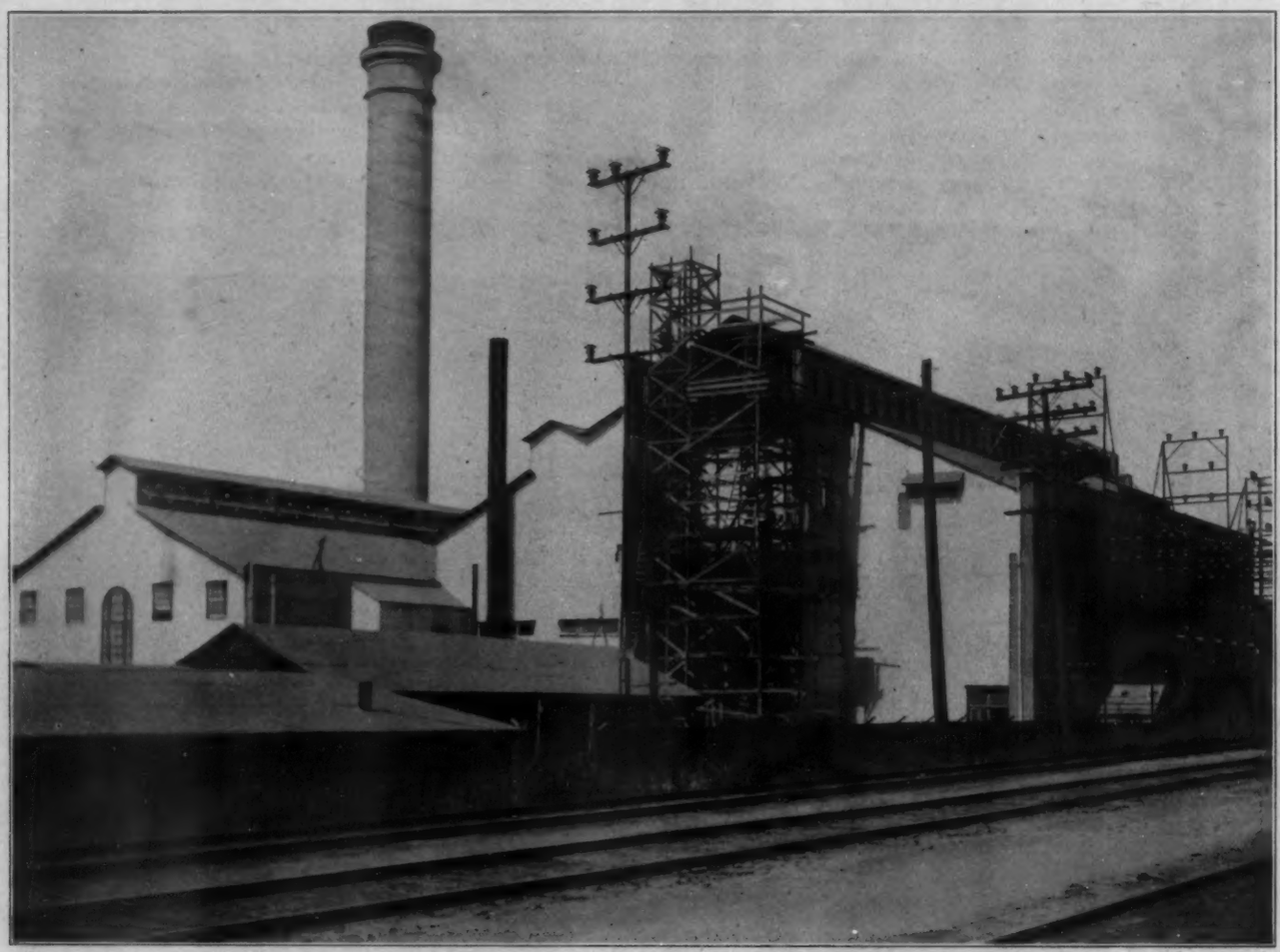
tunnel has been installed to the power house, which latter has been built on the bank of the river directly opposite the intake of the above-named company. Therefore, immediately after being used in The Edison Electric Company Station No. 1, the water is again taken from the river and utilized by the Bakersfield Power, Transit and Light Co.

The diversion dam in connection with The Edison Company's Kern River Station No. 1, consists entirely of cyclopean concrete The dam is constructed directly on bed rock, and the crest of the dam is 1.25 feet above the flow line in the diversion conduit tunnel. The length of the dam along the crest is 203 feet. The height of the dam varies, due to the varying depth of bed rock in the river channel The lowest point, however, of the bed rock is 35 feet below the bed of the stream.

In constructing the diversion dam, a coffer dam was built which diverted the river, while the excavations were being made in the river bed. Trenchs were then cut in the bed rock, and holes were bored into which steel bars were driven in two rows completely across the bed of the river canyon. After this preparation, the concrete was placed on bed rock and tied in by the trenches and steel bars. The diversion dam is of the overflow type, the crest being about 20 feet above the ordinary water level.

The head works of the diversion tunnel consist of enlarged and widened sections of the intake. The flow of water at the intake is controlled by gates all constructed of concrete and iron, and operated by hydraulic cylinders. Screens made of slanting iron bars extending both in front and on the side of the controlling gates, the bars being spaced about 3 inches apart, are solidly built in the tunnel, which at the location of the screens is enlarged to 6 feet, so that there will be sufficient area for the water to enter the tunnel without any contraction. The arrangement of screens is very complete, and includes a platform placed behind the screens for the purpose of raking and removing leaves and other material which might clog the screens if left where caught. The grade of the tunnel at the entrance is increased considerably in order to accelerate the water from its state of comparatively small velocity of flow in the forebay.

During construction a tunnel was built to divert the water above the diversion dam. This tunnel is now used permanently as a drainage or sluicing tunnel, and fulfills this purpose most admirably. It was driven through the bed rock below the intake, and penetrates to the bottom of the pool above the diversion dam. The entrance to this tunnel is protected by grizzlies made of 70-lb. T rails, and has two gates which are controlled by hydraulic cylinders which are operated by oil pressure, the oil being pumped by means of a triplex pump electrically driven. The oil pressure varies from 35 to 40 feet, and is increased or diminished as the amount of water flowing over the dam varies. The hydraulic cylinders are designed to move the gates under the head of water which would result if 20 feet of water flows over the dam, should such a flood ever occur.



LOS ANGELES NO. 3, SHOWING HIGH TENSION LINES ENTERING AND LEAVING

One extremely interesting feature of the hydraulic development of this plant consists of the tunnels. The character of construction of these tunnels, coupled with their permanency and size, makes the hydraulic development of the Kern River Station No. 1 of The Edison Electric Company one of the best ever built. The following table shows the number as well as the length of each of these tunnels, which aggregate approximately 8 miles between the intake and the head of the force main incline tunnel which leads the water

from the water conduit to the power house:

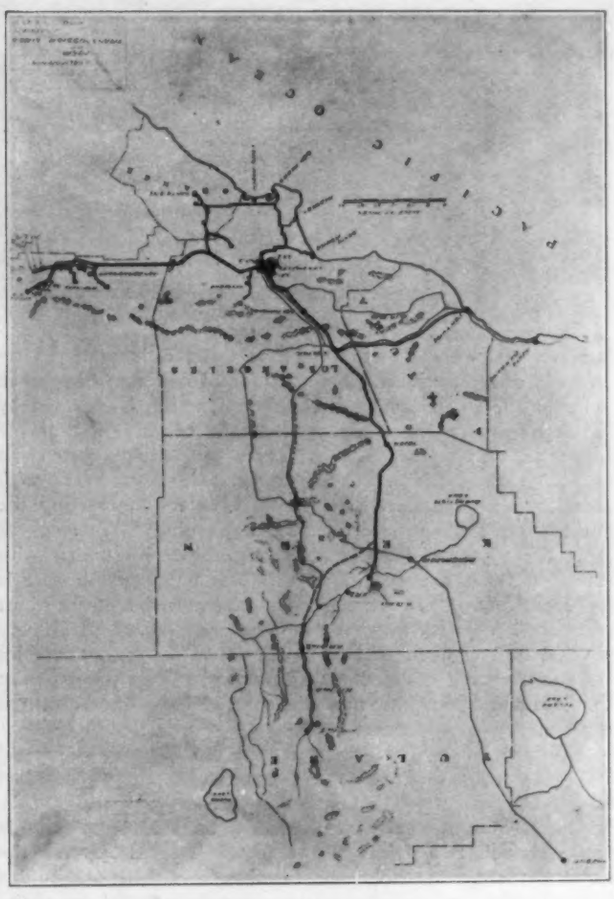
No. of Tunnel.	Length in feet.
No. 1	595
No. 2	237
No. 3	4,049
No. 4	496
No. 5	1,522
No. 6	1,805
No. 7	874
No. 8	3,816
No. 9	2,050
No. 10	3,011
No. 11	2,587
No. 12	2,170
No. 13	2,335
No. 14	4,374
No. 15	3,768
No. 16	1,498
No. 17	1,898
No. 18	2,131
No. 19	794
Total	42,910

WATER COMING FROM END OF TUNNEL INTO FOREHAY

These tunnels, as excavated in the rock, are 9 feet wide, 7½ feet high from the bottom to the spring line of the arch, and 9 feet high from the bottom to the center of the arch. All of the tunnels are lined with concrete 6 inches thick on the sides and 4 inches thick on the bottom. The entire surface of the sides and floor is plastered with cement mortar, leaving the net section of the tunnel 8 feet in width and 7 feet in height. This section of tunnel was adopted as the most advantageous for the purpose owing to the loose and shattered formation of the rock and other material through which the tunnels are constructed. The grade of the tunnel is 7.92 feet per mile, and it is assumed that the depth of the water will never exceed 6½ feet as a maximum. With this depth the area of the cross section of the stream will be 52 feet. The wetted perimeter is 21 feet, and the mean hydraulic radius 2.5 feet. With the grade of the tunnel as given above and assuming the co-efficient of roughness or **n** to be .012, the approximate capacity of the tunnels by Kutter's formula is 470 cubic feet per second.

All of the tunnels as has been set forth above are arched where they pass through seamy or shattered rock or other material. These arches were made by using a templet with lagging over head. After the lagging was put solidly in place, concrete was thrown back and on top of the lagging and thoroughly tamped in place. With this construction, therefore, the possibility of the tunnels caving in from above is practically eliminated. On the sides of the tunnels all cavities between bed rock and the concrete wall, caused by blasting in the construction of the tunnel, have been filled with riprap, the interstices of which were filled with sand and gravel.

Practically all of the excavation for the tunnels was being



MAP OF TRANSMISSION LINES, THE EDISON ELECTRIC CO.

done with 3¼-inch cylinder air drills. In addition to these, some hand drilling was done, especially in opening up the approaches and in places where loose formation was encountered. The air drills were all used in the face of the rock, and the rate at which material was removed averaged approximately 5 feet for each shift of ten hours. The number of holes required for breaking the rock varied from 10 to 24 in the tunnel face, and the depth of the holes driven ran about

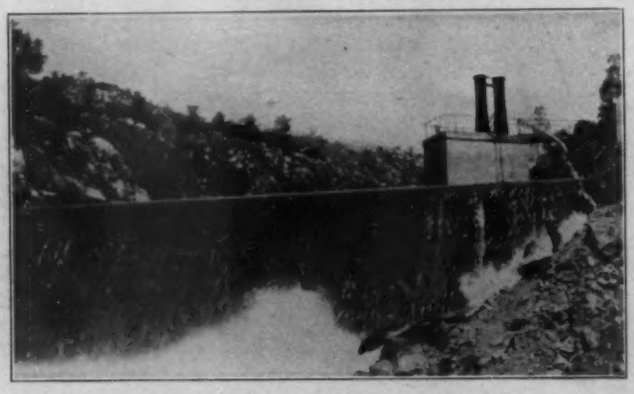
as follows:

Cut-ins—8 to 9 feet.
Lifters—6 to 7 feet.
Breast holes—6 to 7 feet.
Back holes—5 to 6 feet.

In as much as the construction of the water conduits in the tunnels was made thoroughly permanent, the timber flumes required for spanning the ravines were shortened as much as possible. In some cases timber flumes were, of course, necessary in order to preserve the general alignment and make the water conduit system as short as possible. In all cases the flumes were located so that there is little danger of rock or other heavy material falling into the flume from the mountain side above. The amount of flume construction in the entire water conduit system is given in the following table:

No. of Flume	Length in Feet.
No. 1	1,030
No. 2	130
No. 3 (Steel Flume)	50
No. 4	73
No. 5	168
No. 6	70
	1,521

All of the above flumes are wood, with the exception of



OVERFLOW DAM

flume No. 3, which has a steel frame, and is in reality a reinforced concrete flume. Foundations of concrete have been built for the entire length of the flumes, and it is believed by the engineers of the company that the construction of the frame as well as the sub-structures and flumes proper is such that their life will be between 30 and 40 years with practically no repairs. The frame work for supporting the flume boxes is made entirely of Oregon pine, in as much as there is no part of this timber which comes in contact with the earth or is exposed to water. The flume box proper is made entirely of 3-inch redwood planks sawed from the butt ends of Sequoia redwood trees. The edges of all planks are beveled and caulked with ship chandlers' oakum, the sides and seams being covered with an especially designed batten so placed that asphaltum can be poured between the batten and the side of the flume.

On the bottom of the flume hot asphaltum was poured along the seams, and before cooling 1x6 battens were nailed down, thereby entirely filling all cracks.

At all points where the flume connects with the portals of the tunnels two points of contact are offered between the wood and concrete. The construction is such that should a leak occur at the junction, the water can be pumped out of the cavity left and the leak repaired. The reinforced concrete tunnel No. 3 rests on steel frames, and the whole structure is carried on steel I beams resting on concrete piers. A frame work of structural steel for the flume is erected on these I beams, in connection with which are two layers of expanded metal, which hold the plates together, including the flume. The expanded metal is filled with concrete, which is reinforced with steel rods.

This construction is plastered inside and outside, making the entire thickness of the flume proper about 4 inches.

(To be continued.)

THE TELEPHONE ENGINEER'S PROBLEM.*

By Mr. C. E. Fleager.

I have taken this subject tonight in order to point out to you a few of the problems necessary to be considered by the telephone engineer in determining the size and layout of the complete telephone plant in any city.

The first thing to be considered is how large the telephone plant is to be and to what limits it will grow in a given time. If the field is already covered by a telephone company in operation and one wishes to come in competition with them, the study will be more complex as it will mean taking into account the existing company's plant, service, rates, etc. Assume for simplicity that we are to be the only one in the field and that we may expect to reach at least the development to be found at present in other cities.

The first step in determining the present size then would only be to ascertain the exact population of the city and multiply it by the percentage of development. This development varies in different cities and is higher on the Pacific Coast than in the eastern part of the United States. One telephone per ten inhabitants may be taken as a fair average for the Pacific Coast.

The ascertaining of the population will often be a simple proposition but can readily assume a harder aspect. Take Seattle, for example. This city had a government census population in 1900 of slightly over 80,000. Applying the average growth percentage of the whole United States will give Seattle at the present time a few less than 100,000 population. This we, of course, readily know will be too small, as the growth of this portion of the country is seen to have been much more rapid than the longer settled eastern portion of the United States. The question then is how much too small? This can be more or less accurately found out by consulting the business directories and school census of 1900 and of today, and such other public statistics as may be at hand. It will also be well to interview as many as possible of well-informed public citizens, getting their estimates and reasons for same. After the present population of the city has been decided on one can approximate the number of telephones to be connected.

Figuring from the past record of the city it will be easy to establish what growth is to be reasonably expected for coming years. Considering the possibilities of change in the method of operating, depreciation of apparatus, improvements in the system, etc., balance the construction, maintenance and operating costs to determine the number of years for which the original construction shall be planned.

Next determine the distribution of probable subscribers and figure how many exchange districts will be necessary to produce the most economical plant. To do this it will be necessary to assign to each block in the city the probable number of exchange lines and then determine by a "cut-and-try" method roughly what the construction, maintenance and operating costs will be for several different numbers of exchanges. With one exchange the average wire length of subscribers' lines will be greater than with two or more exchanges, and, therefore, construction cost of outside plant will be larger. However, the office plant will be cheaper with one exchange, as it is easily evident there will be less cost in erecting one plant to do all the work than two plants, each doing a portion and requiring intercommunication.

With one exchange the operation is much reduced, as all answering operators having the multiple jacks in front of them can complete their calls to these numbers direct, whereas if two exchanges were in use a large percentage of the calls would necessarily be trunked. That is, the percentage of trunked calls with a one-exchange plan will be much less than with two exchanges. As the percentage of trunked calls increases, the operating costs increase, as on a trunked call it is necessary for two operators to complete the connection,

*Lecture delivered to the students in Electrical Engineering at the University of Washington, Seattle.

while on a call to the multiple in front of her the "A" operator completes the connection without assistance.

In determining the proper number of exchanges it is necessary to study the geography of the city with a view of obtaining information as to possible streets on which underground and aerial systems may be constructed. Often natural divisions, such as lakes, rivers, ravines, etc., greatly increase the wire distance from any proposed exchange center to a particular section. These natural boundaries taken in account with the number of probable subscribers in that district may give a division so that the city may be studied as two separate parts. For example, the government canal, Lake Union and Union Bay divides the northern portion of Seattle from the southern.

Taking this portion of the city and taking the chart with the probable subscribers per block, obtain the wire center, figuring that there is to be but one exchange. This wire center is usually found by the graphic method as follows:

Consider that the city has only streets at right angles to each other and determining the total number of stations, draw a line parallel to one set of streets so that you have an equal number of stations on each side. This can be done by drawing a ruler down the map, counting the stations as they are passed until the half is on one side. Similarly determine the line at right angles which bisects the number of stations, and the intersection of the two lines should be the wire center, provided there are no obstacles or diagonal streets.

Where obstacles occur it will be correct to find the wire center as if there were no obstacles and to determine the number of stations which can not be brought to this center by following the shortest rectangular path. These are considered as being bunched along the nearest axis and a recount will move the wire center along that axis towards the point where the stations affected by the obstacle have been considered bunched. This new wire center will be the correct one.

Diagonal streets will tend to reduce the mileage in their district. They will not materially affect the wire center where they are found in only one quadrant of the district. Where such streets are found in two quadrants it may affect the wire center, though it is not probable. If found in three quadrants, they will probably change the location, but no method of easily determining this is known. It is necessary to figure the mileage for such stations as are affected, balancing the three quadrants against each other.

When the wire center is obtained the number of wire miles and, hence, the outside construction cost can be computed. At this time one can also determine the central office cost, probable operating cost, etc.

Then try this district with other number of exchange centers, finding the wire center for each and computing the different costs and charges. It is possible to have a separate exchange for each block or even for each subscribers' station, but of course it will not be necessary to proceed with figuring to such an extreme.

When the cost for each number of exchanges has been obtained, it will be in order to balance the fixed charges (such as interest on investment, cost of operating, etc.) one set against another and decide on the number of exchanges that gives the lowest fixed charge. It may be that there will be two different plans, giving practically the same fixed charge. In such a case decide on the one requiring the lower original investment.

In general, the correct number of exchanges will be governed mostly by the cost of the outside plant and this will be found to be a minimum when the sum of the exchange wire mileages plus the trunk mileage is a minimum. Trunk mileage will depend upon what is called specific trunk capacity; that is, the number of messages one trunk can carry in unit time.

The number of exchanges and wire centers for each being found, the next step would be to obtain information as to the purchase of real estate located at the wire centers. This would probably be referred to the business management for action, and when deeds of the property are on file the engineer may proceed with the actual planning of the construction of the exchange.

This may be divided into two parts, the inside and outside plants. In taking up the study of the inside or central office plant, will assume that the engineer has decided upon some manufacturer whose equipment is superior and with which he is supplied with full details and drawings by the manufacturer. His problem is to plan an office that will meet with requirements for a comparatively short period of time, called the "initial period," and that can be increased until the ultimate development is reached. If the number of subscribers that shall be expected is known and this has been decided in the original study of the conditions of the city, the total amount of multiple jacks can be determined, and if the ctiy is divided into two or more exchanges the number in each will have been determined.

Given, then, the size of the exchange in terms of the number of subscribers to be connected, what will be the traffic or number of daily connections to handle? To answer this question the engineer must have complete knowledge as to the policy to be pursued by the business management in the matter of rates, etc. If a flat rate charge is to be made for rental, the amount of traffic will naturally be higher than if a message or nickel rate is to be adopted. If the company has a traffic department that department should make a study of the traffic expected at each exchange, determining the number of operators necessary to handle each class of business. If no such traffic department exists it will be necessary for the engineer to make the study. It will be necessary to classify the expected stations in each exchange into such classes as hotel systems, wholesale, retail and office telephones in order to obtain a good line on the traffic.

It will also be necessary to study the direction of the traffic; that is, what traffic may be expected to occur between different exchanges. This will be necessary as it will be plainly obvious that should the "A" operators in any exchange be compelled to make all their connections to another exchange they will be unable to make as many connections as were they to complete all connections in the multiple in front of them in their own exchange.

After the probable traffic has been obtained a knowledge of the amount each operator should properly handle will decide the number of operating positions necessary. The amount of originating traffic in each exchange determines the number of "A" positions and the amount of traffic between exchanges determines the number of "B" positions. This should be determined both for the present requirements and for the requirements of the period decided on as the ultimate.

After the amount of ultimate equipment has been decided on the engineer should prepare a front equipment drawing showing all equipment and how it is to be arranged in the face of the board, also showing what is to be the initial equipment and where it is to be located. It will also be necessary to prepare plans showing the size and location of switchboards, power plant, distributing frames, desks, etc. In preparing these he will have the exact size of the lot on which he proposes to erect a building, the size of all apparatus, and will have taken into consideration the best arrangement of the various parts of the plant.

He should then prepare a specification covering in detail each part of the plant, giving the ultimate equipment desired and what shall be installed at once. This specification may, for convenience, be divided into divisions, such as subscribers' board, trunk board, power plant, etc. It should give as references, drawings showing all circuit arrangement of terminals on the distributing frames, arrangement of cables in runways, arrangement of fuses on fuse panel and all other information so that each and every part may be installed in accordance with proper plans.

If a contract is to be let for the erection of this plant, it will also be necessary to prepare additional specifications covering in detail what grade of material, methods of manu-

facture, and what inspection tests are to be made in manufacturing and accepting the plant. Specifications should also be prepared to give all information necessary for the mechanical and electrical operation of the plant.

After all the plans for the central office plant are prepared rough outlines of the building will have necessarily been prepared. These, together with information as to weight, light, heat, etc., should be handed to the architect for getting up building plans. Specifications covering the quality of material, etc., should be included in this information, as should also information about size and exact location of all special ducts, ventilators, for battery room, cable holes, and such miscellaneous items as are a portion of the telephone apparatus rather than a portion of the building proper.

The study of the outside plant requires more detailed study than the arranging of the inside plant. To reach any one particular subscriber at a distance from the exchange there are often several possible routes of nearly equal length, but which may vary greatly in actual cost of construction and in cost of maintenance. There are also several kinds of construction which give equally good service, but which vary in cost.

Outside construction may be divided into three general classes: underground cable, aerial cable, and aerial wire. The construction study consists of taking the number of stations to be connected in each block and determining from the class of business represented how many lines are necessary, and then planning the proper routes for the wires to take in going to the central office. As one gets closer to the office the number of lines along any one street becomes greater and it is therefore necessary to lay out certain streets for the grouping of the wires together, as it would be impractical to have a lead of wires down every street to the office.

These leads where the wires are grouped are called backbone or trunk leads and in modern construction are of cable, open wire being used only for distribution in the sparsely settled districts. The leads leaving the central office are underground, it being the engineers' work to determine how far this shall be carried before it is placed on poles as aerial cable. This is simply a problem of comparing the cost of construction of the underground system against a similar cost for the aerial system, keeping in mind of course the expected ultimate number of wires.

After it has been decided how much underground is necessary and on what streets it is to be located, a count of the number of wires probable will determine the size of the underground conduit system. When it is decided, plans and estimates should be drawn up to cover this work. Specifications covering quality of material and method of constructing desired should be prepared for use of contractors desiring to make bids on the work or for use of the constructing department if the company desires to do the work itself. These specifications should cover in detail all points in connection with the work in order that a definite understanding may be had.

In addition to the conduit the underground system includes manholes, handholes, and laterals. The engineer should prepare plans and specifications for these and a record to show what style and size of manholes, etc., are to be employed at the various intersections of streets, alleys, etc.

The cables to be pulled in these conduits are made by manufacturers in standard sizes and the engineer should prepare plans and orders showing size and distribution of the cables to be installed. It is customary to install a cable of capacity large enough to last for a comparatively short interval into the future.

The aerial cable backbones are handled similarly to the underground cable; that is, only enough capacity is originally installed to care for the initial period. When the number of wires to be handled ultimately are less than from 300 to 400 pairs, it is found more economical to install them aerially than in underground conduit; that is, the cost per wire mile is less. The engineer should prepare plans showing the initial distributioh, giving the wire numbers that are to be dropped out at all distributing points.

He should prepare specifications, giving in detail all information regarding material and methods to be employed in setting poles, hanging cable, and taking out distributing terminals.

In the distributing from the backbone leads two general classes are to be observed. Those in which the distribution can be made underground and those in which it is made aerially. The underground distribution is usually made to business blocks, a terminal being placed in some convenient location (usually the basement) and distribution made from this terminal with the building wiring. A good method of building wiring is to run cable from the terminal in the basement to each floor (allowing sufficient pairs for each room), locating a terminal box in the hallways in which branch cables are terminated. Moulding can then be placed in the hallway connecting these terminal boxes with the different rooms. Wire can be placed in the moulding as the service is demanded, but the cable should be placed when the building is constructed.

In the aerial distribution which is usually in residence districts, pole lines are run down each street or alley carrying a cable large enough to handle the street for the ultimate. Multiple terminals are taken off at frequent enough intervals so that service or drop wires can be run direct from the terminal pole to the subscriber's premises. These terminals are usually of smaller size than the cable and are arranged in some systematic order to allow of all pairs having the same number of multiples. This should be covered by specifications by the engineer so that a standard may be adopted and followed. It should be the aim of the engineer in all his specifications to adopt some standard and follow it.

For the wiring of houses for telephones some specification should be prepared to cover all points liable to arise, keeping in mind the best construction at a minimum cost. Insurance regulations and concealment and neatness should be carefully considered in preparing this specification.

UNIVERSITY EMPLOYMENT AGENCY.

In order to serve employers more promptly and effectively during the summer, as well as throughout the academic year, the University of California has established a special registry for its graduates who are seeking positions. Chemists, engineers, architects, draughtsmen, surveyors, bookkeepers, bank clerks, stenographers, etc., are now registered by the appointment secretary, who secures evidence in regard to each man's qualifications and who is prepared to furnish this information to employers at any time. Business houses may be supplied with men for almost any line of work, the College of Commerce furnishing men especially fitted for taking up mercantile work. The College of Mining sends out men trained for work as mining engineers, assayers and prospectors.

Many undergraduates are registering for work during the summer vacation, which runs from May 15 to August 15. Summer hotels may obtain extra clerks, and railroad surveying parties men for work with the chain and rod. Men may be found for fruit picking and packing, for work with express companies and in stores. In making application for men, employers are asked to state clearly the work to be done, when it must begin and the pay offered. Also please state whether the work will be temporary or permanent, and the cost of living, if possible. Address Gurden Edwards, alumni secretary, 203 California Hall, Berkeley, California

RULE OF THUMB VS. ENGINEERING.

In a recent issue of the Electrochemical & Metallurgical Industry, there appears an interesting essay by Mr. Joseph W. Richards, professor of metallurgy in Lehigh University, in which he says that the "engineer" is one who strives to perfect his work, the "artisan" works to get through with it; the first labors for intelligent love of his work, the latter "quits when the whistle blows"; the first puts "gray matter" into his labor, the latter only muscle and experience.

Ever since man emerged from prehistoric savagery, the one who weighed chances, measured his resources, and ordered his actions by intelligent foresight, has earned the place and deserved the title of "the fittest." Engaged as we all are in receiving impressions, recording observations, gaining experience, that man alone is wise who profits by this information to lay down rules for the guidance of his future conduct, for the ordering of his future actions.

The English definition of an inch is that it is "the twelfth part of a foot and equal to three barleycorns." The foot was, of course, originally the average length of the pedal extremities of a race of people, and it was not only natural but inevitable that, for example, the French foot should differ in length from the German foot, etc. Not wishing to pursue this branch of our inquiry to too great and perhaps tiresome lengths, we may as well recite at once a striking and suggestive fact, whose connection with our argument may not be at once apparent, namely, the French word for an inch is pouce, which is also French for the thumb. The connection implied, is, of course, that an inch, in France at least, and probably in England also, was originally the length of the second joint of the thumb, which varies less in different people than would at first thought be imagined.

In the absence, therefore, of a proper foot rule marked into inches and fractions, it was customary at one time to measure lengths of small dimensions with the thumb joint, and so get an approximation of the number of "thumbs" in a given length. It would be ill-advised, if not conceited, for us to poke fun at or wax sarcastic about the absurdity of such practice, for the "rule of thumb" was a valuable practice when compared with what it displaced—no rule at all; and just as imperfect laws are better than total lawlessness, so the "thumb rule" marked a decided advance toward the arts and sciences.

Somewhere later in time than the period we have been considering, measures of length accurately compared with an arbitrary standard began to multiply and to displace the "rule of thumb." Artisans could then begin to work with exactness, the carpenter could plan and scheme ahead accurately by measure, the smith could forge articles to any required stated size, the gentleman could order from his tailor trousers so many inches long, without allowing for the different lengths of thumb of his sartorial "churls." This period having arrived, and this stage of advancement in the arts and sciences having been reached, we are now prepared to let loose the vials of our criticism, or, perhaps, indignation, and with perfect justification, upon the unlucky wight, who, either from inborn "cussedness" or acquired laziness, continues to afflict humanity with "the rule of thumb." Here is the unpardonable sin: the accurately divided rule has come and the confirmed sinner sticks to his "thumbs" and "barleycorns."

Having dragged the reader through this somewhat misty prologue, it is becoming that we state exactly what we mean to preach further about. It is just this: The difference between "rule of thumb" and accurate calculation, the wide gulf separating the hit-or-miss, cut-and-try methods of the ancients and the scientifically informed practice of the modern technologist. Not that we are going to hold up the former to ridicule or the latter to extravagant adulation, but we wish to discuss some of the features of modern technology which illustrate the great change which has taken place and the still greater changes which are possible.

To take an illustration from civil engineering: Spanning the Firth of Forth, a few miles above Edinburgh, stands the greatest structure of th epresent time. With clear spans of 1700 feet, capable of carrying the heaviest trains, the strains and stresses in each of its thousands of members all accurately calculated beforehand, here is a monument to engineering skill absolutely unthinkable as a product of "rule of thumb."

Look once more at the electrical engineer and his achievements. A huge dynamo spins like a top on a shaft 160 feet deep and develops in the smallest compass imaginable 10,000 horse power. The diameters of the armature wires are accurate to the thousandth of an inch, the hundreds of turns of wire are neither one too few nor one too many, the very phases of the pulsations of the electric waves are mapped and studied out so as to bring out the maximum efficiency. Soft iron from Norway, mica from Canada, rubber from Paraguay, copper from Arizona, shellac from China, steel from Pennsylvania are combined with the most consummate skill and accurate calculation into a huge giant, which works day and night with almost the regularity of a planet. "Rule of thumb" could never have conceived of such a product; only "engineering skill" has made it possible.

One art and one science still bear much of the stigma of "rule of thumb"—the science of chemistry and the art of metallurgy. Chemistry remained alchemy until the invigorating breath of modern methods commenced to blow away the mists of mystery which enveloped it. The evolution has been long and laborious. Conservatism in the manager combined with stubborn old-fogyism in the workman, have conspired against enlightening methods to keep the industry in the rule-of-thumb rut. Germany was the first country to break away into scientific and engineering chemistry, and the lead thus gained has been maintained to this day. The Britisher, workman or manager, is the most conservative of human beings, and his backwardness in following Germany's methods is the chief cause of the industrial difficulties under which the British chemical industry now labors. Metallurgy is still rule-of-thumb in many countries, such as Central Africa (production of iron), China (production of lead and mercury), Straits Settlements (reduction of tin), where aboriginal methods still largely survive. But the aboriginal spirit is preserved in many other so-called civilized countries. It persists among the Cornish and Saxon tin workmen, the Derbyshire and Coriuthian lead smelters, the Welsh and Mansfield copper refiners, the Alaskan and Siberian gold winners, the Missouri and the Silesian zinc distillers, the Almaden and Idrian mercury mines, the Eastern Pennsylvania as well as the Lithuanian blast furnaces.

Among all of these, and others too numerous to mention, are to be found that reverence of tradition, that willingness to keep plodding in the rut, that indisposition to apply the discoveries of modern science, that ignorance of what modern science has disclosed, which keep them groping in the semi-darkness of medievalism, while their more intelligent neighbors are running away from them like an express train distancing a stage-coach.

The Electric Storage Battery Company of Philadelphia have just issued the tenth edition of their Price List "X," which describes their Exide type of battery in electric vehicles and sparking service. Copy of this price list will be forwarded upon application to any of the company's sales offices or Exide depots.

The JOURNAL of ELECTRICITY POWER AND GAS
WITH WHICH IS INCORPORATED
The Engineers' Architects' and Builders' News

Published Weekly by
THE TECHNICAL PUBLISHING COMPANY
SUCCESSORS TO
The Journal of Electricity Publishing Company
304 Atlas Building, San Francisco.

Yearly subscription, $2.50. Single copies, 10 cts. Back numbers prior to the current month, 25 cts. Foreign subscription, $4.00. Subscriptions cannot be begun with back numbers. Manuscripts submitted must be accompanied by postage to insure return.

Address all communications and make all remittances payable to The Technical Publishing Company.

EASTERN AGENCIES
NEW YORK
CHICAGO
ST. LOUIS

WESTERN AGENCIES
LOS ANGELES
PORTLAND
SEATTLE

Entry changed May 1, 1906, to "The Journal of Electricity, Power and Gas," with which is incorporated "The Engineers', Architects' and Builders' News."
Entered as second-class matter at the San Francisco Post Office, August 15, 1899.
Entered as "The Electrical Journal," July, 1895.
Entry changed to "The Journal of Electricity," September, 1895.

VOL. XVIII JUNE 1, 1907 No. 22

EDITORIAL.

The Real Situation in San Francisco—What is It?

It is impossible for any citizen with eyes to see, if he be not blinded by ulterior motives, immediate profit or reckless partisanship, to ignore the conditions in San Francisco today. As a part of the nation and the State, the people of San Francisco are sailing through a Scylla of Labor and a Charybdis of Capital. The problems of industrial economy, involving the co-operative and equitable division of both profit and loss, have been thrust upon us with precipitate suddenness. Some of us who have seen a little distance in the future have hoped that such problems would not need to be solved in our day, but might be left to be worked out by the next generation. We, who have seen San Francisco built up and then torn down by ruthless elements in the space of only three days, have imagined that there was enough for us to do without attempting to solve the severest, though inevitable questions, which have made capital and labor antagonistic instead of, as the natural laws of economy direct, thoroughly co-operative and sympathetic.

But the situation is upon us, and with that dauntless spirit, which each fateful dawn gave fresh heart to the pioneers, we must not flinch and fail to do the duty of our day. There is no occasion to indulge in gloom or supplication over the grievous quarrels that now overwhelm San Francisco. Rather must we strive to face the difficulty fairly, squarely and honestly with no ulterior motives, in the hope of finding a way over them.

"Quit ye like **men**" should be the watchword of the hour; like fair and honest men of intelligence and strength. If we ignore the complaints of the downtrodden—even though their grievances may seem trivial or imaginary—we are not just, and indeed, the same fairness is needed toward those of high estate whose names to-day are the by-word of the newspapers and the targets of prosecution. Toward what end are we expending our energies, our complaints and our disorders? Is our goal peace and prosperity, or will the result be riot and revolution?

Even the argument of the Socialist is not to be carelessly cast aside. It must be considered with patience. Only this week a London correspondent of the "Journal" writes:

"Socialism as exemplified in England is a system of degeneration; a palsied thing. The conversion of Great Britain to Socialism would have meant its perversion into a gigantic workhouse."

The "workhouse" in England is the last resort of the improvident and the vicious. The wise men of England, among whom we may safely include our correspondent, thank heaven, and their sturdy ancestors too, that "the thing" got a "thorough knock-out" at the last municipal election.

Sometimes it is well—yes, even necessary—to get away from our immediate environment in order to get a true perspective of ourselves. In an interview this week Lord Rothschild, the head of the greatest financial power in the world, said:

"The best that can be said is that the markets are no worse to-day. Perhaps they are slightly better, but with President Roosevelt attacking the railroads in one part of the world, the income tax question and other problems in France, and the Socialist movement in England, the people are killing the goose that laid the golden eggs, and we can expect nothing more than what the market position reveals."

Suppose Capital should choose to grow weary of the strife with Labor and shut up shop, realizing upon its securities in this country as best it could and retire abroad in Astorian or Carnegian vein: What, then, would happen to Organized Labor? Even we, the consumers and the passengers, the third party to the strife, would inevitably suffer.

Labor may strike at Capital, but in the meantime, also, in our time, at least, it is obviously possible for Capital to as effectively lock up Labor. The "Journal" holds no brief for either the special privileges of the few—whose rule in politics has been predominant—or for the exorbitant demands of the Labor Trust. We deplore the extravagances of both classes, and as well the fact that, instead of marching side by side to the goal of industrial peace and prosperity,

they should be so perpetually and so fatally aligned against each other.

In our own case—the troubles and disorders, industrial, political and social, which now vex San Francisco—we must keep cool heads and strong hearts. We must fight valiantly for industrial freedom—for the lawful rights of the individual—or inevitably succumb to the thraldom of Labor Union dictation and tyranny.

Nor is it possible to ignore the fact that the situation indicates that some private conspiracies may beset us. Mr. Rudolph Spreckels and his associates have undoubtedly done much good in uncovering graft and corruption in San Francisco, but it is well to ask ourselves if there is even a remote possibility of there being wolves in sheep's clothing among us. No possible autocracy—concentration of political and industrial power in a single individual, or, indeed distributed among a single class—is possible if we would maintain our heritage of Republican institutions and the faith of our fathers. It must be admitted that there are keen and far-seeing observers who fear that the graft prosecutors in San Francisco are being used—beyond their kin—in a gigantic conspiracy to concentrate the control of public utilities and political power within far narrower and more dangerous limits than those which have existed in the immediate past.

Suppose for a moment that the seeming ambitions of the graft prosecutors were completely gratified; that the men in charge of the management of the United Railroads, the Telephone Company, and the Gas and Electric Company, were all sent to the penitentiary. Also that the franchises of the United Railroads were all cancelled and that the direction, and hence eventually the ownership, of all of the above-named public utilities were to pass into other hands.

Can it be said that those who have made possible the exposure of graft in San Francisco are infallible and omnipotent? Are they actually so superior to the rest of us that they would direct such interests, both industrial and political, against their own ambitions, working solely and wholly for the public good, inspired only by patriotic and unselfish impulses? Even were such admirable persons to be found anywhere in San Francisco, would such a condition be worthy of our American and Republican institutions, or significant of our independence and consistent with our birth right as free-born Americans? We do not wish to imply that there are those interested in the prosecution of graft in San Francisco who are in reality not what they seem, but in the interests of all, we most earnestly recommend the contemplation of these dangers to each and every one having the ultimate future greatness of San Francisco at heart.

Whatever Mr. Patrick Calhoun may have done, he, with his other associates of the Telephone and Gas and Electric companies, who are under a cloud, have done inestimable service to San Francisco and California. Mr. Calhoun, almost alone, has successfully waged a battle for industrial freedom in San Francisco, and his victory will do more for the city's future greatness than any other thing which could have been done; and if there be hidden conspirators in any disguise, it is certain that Mr. Calhoun and the United Railroads will never cease fighting back until ultimate victory is won and the people of San Francisco have revealed to them the real situation. They scorn the tyranny of such government as we have bowed to since the confession of the conscienceless Supervisors; they are alert to the dangers that menace the enterprise and honesty of individual effort. Nor are they to be terrorized by the calumnies or assaults of an unlicensed press. They declare they have nothing to be ashamed of, and are prepared to prove it.

Let us, then, exercise patience and wisdom, and if we are really seeking the truth, we undoubtedly will be rewarded; but in the meantime let us be prone to no hero worship, and let us guard with the utmost vigor our complete independence, both of action and judgment. Before we accept any one as the undisputed dictator in San Francisco, let us await with patience until without question we know surely and for all time what is the "real situation."

PERSONAL

Garnett Young, manager of the Telephone and Electric Equipment Company of San Francisco, was in Los Angeles during the past week.

George Nixon, of Nixon & Kimmel, electric engineers and contractors in Spokane, Wash., has returned home after a short business trip to San Francisco.

Otto E. Falch, Jr., has opened offices as consulting electrical and mechanical engineer at 850 Monadnock Building, San Francisco, having resigned his position as chief engineer of the Pacific Coast department of the Otis Elevator Company.

TRADE CATALOG

Allis-Chalmers Co., Milwakee, Wis., send Bulletin No. 1058, describing and illustrating the Winona Interurban Railway, between Warsaw and Goshen, Indiana. No. 4005 shows Allis-Chalmers steam turbines and generators recently put in service.

The Holtzer-Cabot Electric Co., Brookline Station, Boston, Mass., sends three interesting bulletins. No. 302A displays the uses of their dynamotors, double-wound machines, in which one armature core holds both motor and generator windings which rotate in a common field, and of their motor generators in which a motor and dynamo are mounted on a common base and connected by means of a coupling, each armature rotating in its own field. These are built in many sizes, from the smallest to the largest. Bulletin No. 303A illustrates and describes their special elevator motors. Bulletin No. 311 contains an interesting account of direct-connected electric generating sets for gas, gasoline or alcohol, sizes 3 to 60 horsepower.

LOCAL STOCKS AND BONDS

Furnished by Courtesy San Francisco Stock and Bond Exchange.

Outstanding	Interest	Miscellaneous Bonds.	May 23		May 24		May 25		May 27		May 28		May 29	
			Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked
1,532,000	F & A	Associated Oil Co. 5%	.....	.....	.....	.....	.....	82	.....	82	.....	82	.....	82
2,250,000	M & S	Bay Counties Power Co. 5%	.....	101	.....	101	.....	101	.....	101	.....	99	.....	99
1,000,000	F & A	Cal. Central Gas & El. 5%	.....	104	.....	104	.....	104	.....	104	.....	104	.....	104
9,600,000	M & S	Cal. Gas & El. Gen. M. & C. T. 5%	75	79	.....	81	.....	80	75	.....	77½	80	75	80
900,000	J & J	California St. Cable Co. 5%	100	.....	100	.....	100	.....	100	.....	100	.....	100	.....
2,000,000	J & J	Contra Costa Water Co. 5%	.....	103	.....	103	.....	103	.....	103	.....	103	.....	102½
1,000,000	J & J	do do Gen. Mtg. 5%	.....	97	.....	97½	.....	97½	.....	97½	.....	97½	.....	97
623,000	F M A N	Edison Light & Power 6%	111	119	111	119	111	119	111	119	111	119	111	119
650,000	M & S	Ferries & Cliff Ho. Ry. 6%	104	.....	104	.....	104	.....	104	.....	104	.....	104	.....
671,000	A & O	Geary St. Railway 5%	45	.....	45	.....	45	.....	45	.....	45	.....	45	.....
610,000	M & N	Honolulu R. T. & L Co. 6%	104¾	.....	104¾	.....	104¾	.....	104¾	.....	104¾	.....	104¾	.....
300,000	A & O	Lake Tahoe Ry. & T. Co. 5%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
500,000	J & J	Los Angeles Elec. Co. 5%	100	.....	100	.....	100	.....	100	.....	100	.....	100	.....
1,300,000	J & J	Los Angeles Gas & Elec. Co. 5%	.....	100	.....	100	.....	100	.....	100	.....	100	.....	100
5,000,000	A & O	Los Angeles Ry. 5%	105	.....	105	.....	105	.....	105	108	.....	108	104	107
1,000,000	A & O	Los Angeles Lighting Gd. 5%	.....	105	.....	105	.....	105	.....	105	.....	105	.....	105
1,500,000	A & O	L. A. Pac. R. R., 1st Con. Mtg. 5%	.....	104	.....	104	.....	104	.....	104	.....	104	.....	104
3,030,000	M & S	L. A. Pac. R. R. of Cal. 5%	.....	100¼	.....	100¼	.....	100¼	98½	.....	98½	.....	98½	.....
3,000,000	J & J	Market Street Cable 6%	.....	110	.....	110	.....	110	.....	110	.....	110	105	.....
5,141,000	M & S	do Ry., 1st Cons. Mtg. 5%	.....	105	.....	107½	.....	107½	.....	107½	.....	104½	.....	106
100,000	A & O	Mill Valley & Mt. Tamalpais S. Ry. 5%	.....	103	102	.....	102	.....	102	.....	103	.....	103	.....
4,751,000	A & O	Northern Ry. Co. of (Cal.) 5%	107½	110	108	110¼	108	110¼	109	110	109	110	.....	110¼
1,498,000	J & J	North Pacific Coast R. R. 5%	.....	103	.....	102½	.....	102½	.....	102½	.....	102½	.....	102
1,074,000	J & D	Northern Cal. Railway 5%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
980,000	J & D	Northern Cal. Power Co. 5%	.....	.....	.....	.....	.....	.....	.....	101	.....	101	.....	101
6,000,000	A & O	Northern Electric Co. 5%	.....	97½	.....	97½	.....	97½	.....	97½	.....	97½	.....	97½
1,000,000	M & S	Oakland Gas Light and H. 5%	.....	107	02	106⅞	102	106⅞	102	106⅞	102	106⅞	102	106⅞
1,274,000	J & J	Oakland Transit Co. 6%	.....	114	.....	114	.....	114	.....	114	.....	114	.....	114
1,600,000	J & J	Oakland Transit 5%	101	.....	101¼	.....	101	.....	101½	.....	101½	.....	101½	.....
1,326,000	J & J	Oakland Transit Con. 5%	.....	101	.....	.....	.....	.....	.....	.....	.....	.....	100	101¼
7,000,000	J & J	Oakland Traction Con. 5%	.....	100½	.....	100½	99¼	.....	.....	100¼	.....	100¼	.....	100¼
1,500,000	J & J	Oakland Water Co. gtd. 5%	.....	97½	.....	99	.....	99	.....	99	.....	99	.....	99
2,000,000	A & O	Omnibus Cable Ry. 6%	112	118	112	118	112	118	112	118	112	118	112	118
1,149,000	S D M J	Pacific Gas Imp. 4%	.....	92⅛	.....	92½	.....	92½	.....	92⅛	.....	92⅛	.....	92½
8,494,000	J & J	Pacific Electric Ry. Co. 5%	100	104	02	102½	102	102½	102	.....	102	103½	101¾	102½
4,491,000	J & J	Pacific Light & Power Co. 5%	.....	100½	.....	100½	.....	100½	.....	100½	.....	100½	.....	100½
3,000,000	J & J	Pacific Tel. & Tel. Co. 5%	.....	103	.....	103	.....	103	.....	103	.....	103	.....	103
350,000	J & J	Park & Cliff House Ry. 6%	100	.....	00	.....	100	.....	100	.....	100	.....	100	.....
250,000	J & J	Park & Ocean R. R. 6%	.....	112½	.....	112½	.....	112½	.....	112½	.....	112½	.....	112½
700,000	M & S	Powell Street Railway 6%	.....	107½	.....	107½	.....	107½	.....	107½	.....	107½	.....	107½
2,500,000	M & N	Sacramento Elec. Gas & Ry. 5%	.....	100½	.....	100	.....	100	.....	100	.....	98	.....	100
6,000,000	A & O	S. F. & S. J. Valley Ry. 5%	.....	111	108	110	108	110	108¼	.....	108	.....	108¼	.....
3,000,000	J & J	S. F., Oak. & San Jose Ry. 5%	102	109	.....	105½	100	.....	.....	105	.....	105	100	107
1,500,000	J & J	do do 2d Mtg. 5%	.....	101	.....	101	.....	101	.....	101	.....	101	.....	101
1,500,000	A & O	S. J. & S. Clara Co. R. R. 4½%	.....	91	.....	91	.....	91	.....	91	.....	91	.....	91
642,000	A & O	Sierra Ry. of Cal. 6%	107	.....	107	.....	107	.....	107	.....	107	.....	107	.....
6,000,000	J & J	S. P. R. R. of Arizona 6% (1909)	103	103¾	103	103½	103	103½	103	103½	.....	.....	102⅞	103½
4,000,000	"	do do do (1910)	103¾	104¾	03⅞	.....	103¾	.....	103¾	.....	103¾	.....	103¾	.....
5,116,000	A & O	S. P. R. R. of Cal. 6% (1912)	105½	.....	05½	.....	105½	.....	105½	.....	105½	.....	105½	.....
4,127,500	M & N	S. P. R. R. of Cal., 1st c. gtd., 5%	112½	117	14	116½	114	116½	114	116½	114	116½	114	116½
3,533,000	A & O	S. P. Branch Ry. of Cal., 6%	121¾	122½	21¾	.....	121¾	.....	121½	130	121½	.....	121½	.....
81,178,000	J & J	S. P. R. R. Co., 1st Ref'd'g. 4%	90½	91¼	90½	91	90	91½	90	91½	90	90½	90	.....
17,500,000	J & D	Spring Valley Water Co. Gen. Mtg. 4%	.....	88	.....	88	.....	88	.....	88	.....	88	.....	88
300,000	M & S	Stockton Gas & Elec. Co. 6%	100	.....	100	.....	100	.....	100	.....	100	.....	100	.....
2,000,000	J & J	United Gas & Elec. Co. 5%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
20,000,000	A & O	United R. R. of S. F. 4%	65	68½	69½	.....	69⅞	.....	69½	71	69½	70	69⅞	70
2,500,000	M & N	Valley Counties Power Co. 5%	.....	102½	.....	100¼	.....	100¼	.....	100¼	.....	100¼	.....	100¼
		Water Stocks.												
.....	.....	Contra Costa	60½	62	60½	62	55	61	55	61	55	61	55	61
6,000	Quarterly	Marin County	.....	62	.....	62	.....	62	.....	62	.....	62	.....	62
280,000	.....	Spring Valley Water Co.	18½	19	19	19½	19	19¼	19	.....	19	.....	19	.....
		Gas and Electric Stocks.												
37,500	.....	Martel Power Co.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
9,340	.....	Mutual Elec. Light Co. (Ctfs.)	4½	.....	4½	.....	4½	.....	4½	.....	4½	.....	4½	.....
37,336	.....	do (Extended Ctfs.)	12½	13¼	12½	13½	12½	13½	.....	13¼	.....	13¼	12½	13¼
40,000	Monthly	Pacific Lighting Co.	.....	65	.....	65	.....	65	.....	65	.....	65	58	.....
12,000	.....	Stockton Gas & Elec. Co.	52	.....	52	.....	52	.....	52	.....	52	.....	52	.....
		Street Railroad Stocks.												
10,000	.....	California	.....	142½	.....	142½	.....	142½	.....	142½	.....	142½	.....	142½
10,000	.....	Geary	.....	41	.....	41	.....	41	.....	41	.....	41	.....	41
10,000	.....	Presidio	.....	25	.....	25	.....	25	.....	25	.....	25	.....	25
	Semi-an.	Associated Oil Co.	29¾	30½	32	.....	34¼	.....	34¼	35	34½	.....	34	.....
1,625	Quarterly	Mill Valley & Mt. Tamalpais S. Ry.	.....	110	.....	110	.....	110	.....	110	.....	110	.....	110
180,000	Quarterly	Pac. Tel. & Tel. (Pfd.)	.....	100	.....	100	.....	100	.....	100	.....	100	.....	100
180,000	.....	do do do do (Common)	7½	15	7½	15	7½	15	7½	15	7½	15	.....	15

Unlisted Securities

750,000	A & O	Bay Counties Power Co. 6%	.....	103	.....	103	.....	103	.....	103	.....	103	.....	103
745,000	M & S	Blue Lakes Water Co. 6%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2,000,000	A & O	California Northwestern Ry. 5%	.....	108	.....	108	.....	108	.....	108	.....	108	.....	108
160,000	J A J O	Marin County Water 5%	.....	100	.....	100	.....	100	.....	100	.....	100	.....	100
600,000	J & J	Risdon Iron Works 5%	.....	100	.....	100	.....	100	.....	100	.....	100	.....	100
500,000	M & S	S. F. Dry Dock 5%	.....	109	.....	109	.....	109	.....	109	.....	109	.....	109
8,000,000	M & N	S. F. Gas & Electric 4½%	.....	95	.....	95	.....	95	.....	95	.....	95	.....	95
3,926,000	J & J	S. F. & North Pacific Ry. 5%	.....	107½	.....	107½	.....	107½	.....	107½	.....	107½	.....	107½
5,500,000	J & J	South Pacific Coast Ry. 4%	.....	95	.....	95	.....	95	.....	95	.....	95	.....	95
.....	.....	Standard Electric Co. 5%	.....	92½	.....	92½	.....	92½	.....	92½	.....	92½	.....	92½
.....	.....	do do Gtd. 5%	.....	95	.....	95	.....	95	.....	95	.....	95	.....	95
750,000	J & J	Sunset Tel. & Tel. Co. 6%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2,250,000	A & O	Sunset Tel. & Tel. Co. 5%	.....	105¼	.....	105¼	.....	105¼	.....	105¼	.....	105¼	.....	105¼
1,000,000	M & N	Sutter Street Railway 5%	.....	105	.....	105	.....	105	.....	105	.....	105	.....	105
		Stocks.												
50,000	Monthly	Gas Consumers' Association	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
100,000	Monthly	Northern Cal. Power Co.	.....	23	19	22	19	22	19	25	17½	20	.....	20
.....	.....	Pac. Gas & Elec. (Pfd.)	.....	55	.....	49½	.....	55	.....	49	.....	50	.....	50
.....	.....	Santa Cruz Port. Cement	.....	65	.....	62	.....	62	.....	62	.....	65	.....	62
.....	.....	Standard Port. Cement (New)	.....	60	15	.....	15	.....	15	17	15	17	15	17
50,000	Monthly	Truckee Electric Co.	15	.....	.....	60	.....	60	.....	60	.....	60	.....	45

APPROVED ELECTRICAL DEVICES.

This department from time to time will contain an illustrated description of all fittings approved by the Underwriters' National Electric Association.

CONDUIT, OUTLET BUSHING.

"Fox" terminal hood. A cast-iron plate and cover for service entrance. Approved for use at service entrance only April 9, 1907. Manufactured by

Fox Mfg. Co., Milwaukee, Wis.

FIXTURES.

O'Brien, show window and show case reflector and lamp. A tubular 16 candlepower, 110-V. lamp, mounted on special porcelain sockets, in metal frame. Approved April 26, 1907. Manufactured by

O'Brien Electric Light Company, Philadelphia, Pa.

FUSE, CARTRIDGE ENCLOSED.

"B.-P." All capacities, 250-V. Approved April 22, 1907. Manufactured by

Briner-Pogue Mfg. Co., St. Louis, Mo.

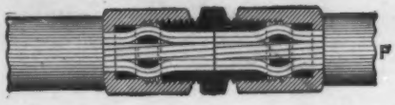
"Shawmut," standard type, all capacities, 250 and 600-V. Approved April 22, 1907. Manufactured by

Chase-Shawmut Company, Newburyport, Mass.

MISCELLANEOUS.

"Dossert" cable joints. Splicing devices for use without solder. Types A, B and C. Approved April 27, 1907. Manufactured by

2 WAY TYPE A



2 WAY TYPE B

Dossert & Co., New York, N. Y.

G. E. ground connection pipe clamps, removable lugs bolted to strip bronze clamps, all sizes. Cat. Nos. 4325, 4330, inclusive. Approved April 22, 1907. Manufactured by

General Electric Company, Schenectady, N. Y.

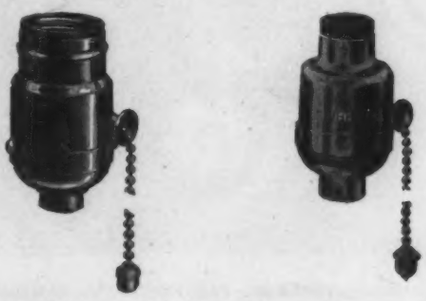
PANELBOARDS.

Crouse-Hinds, 125 and 250-V.; 2-wire, equipped with standard type enclosed fuse cut-out. Approved April 26, 1907. Manufactured by

Crouse-Hinds Co., Syracuse, N. Y.

SOCKETS, MINIATURE.

Hubbell, candelabra pull socket, ½-A., 125-V., and candelabra extensions ½-A., 250-V. Approved April 26, 1907. Manufactured by



Harvey Hubbell, Bridgeport, Conn.

CABINETS.

G. E. wooden, asbestos lined, except for use with metal conduit systems. Approved April 6, 1907. Manufactured by

The General Electric Co., Schenectady, New York.

FLEXIBLE CORD, PENDANT.

Tag on coil to read "Guaranteed Nat'l Elec. Code Standard.".

Marking: Yellow cotton thread cabled with copper strands. Approved April 3, 1907. Manufactured by

American Electrical Works, Providence, R. I.

Marking: Soft woolen thread on rubber surface lengthwise of wire and under braid. Approved April 3, 1907. Manufactured by

American Steel & Wire Co., Worcester, Mass.

Marking: Red, white and blue thread, cabled with copper strands. Approved April 3, 1907. Manufactured by

Crescent Insulated Wire and Cable Co., Trenton, N. J., for Alfred F. Moore, Philadelphia.

Marking: Green threads in cotton wound around copper strands. Approved April 3, 1907. Manufactured by

General Electric Co., Schenectady, N. Y.

Marking: Two ridges on rubber insulation. Approved April 3, 1907. Manufactured by

Goodyear Rubber Insulating Co., New York.

Marking: Blue cotton thread, cabled with copper strands. Approved April 5, 1907. Manufactured by

National India Rubber Co., Bristol, R. I.

Marking: Ridge on rubber insulation. Approved April 3, 1907. Manufactured by

Okonite Company, Limited, New York.

Marking: One red thread cabled with copper strands. Approved April 3, 1907. Manufactured by

John A. Roebling's Sons Co., Trenton, N. J.

Marking: Yellow thread in cotton wound around copper strands. Approved April 3, 1907. Manufactured by

Safety Insulated Wire and Cable Co., New York.

FLEXIBLE CORD, PORTABLE.

Marking: Red cotton threads upon smooth rubber surface lengthwise of wire and under braid. Approved April 3, 1907. Manufactured by

Simplex Electrical Co., Boston, Mass.

Also each brand approved under flexible cord, pendant, was approved under flexible cord, portable.

ROSETTES, LINK FUSE.

"Bryant Junior" cleat, Cat. No. 1501, and concealed No. 1502, combined cleat and fusible rosette, No. 965, 2-A., 125-V. Approved April 26, 1907. Manufactured by

Bryant Electric Co., Bridgeport, Conn.

SWITCHES, AUTOMATIC.

Pettingell-Andrews for remote control, up to and including 200 A., P. C., 250 A., A. C. 440 V. One, two or three pole toggle mechanism, operating laminated copper switch blades by means of control circuits energizing magnates, with or without special iron box. Control circuit to be wired throughout as for low potential systems. Approved April 29, 1907. Manufactured by

Pettingell-Andrews Co., Boston, Mass.

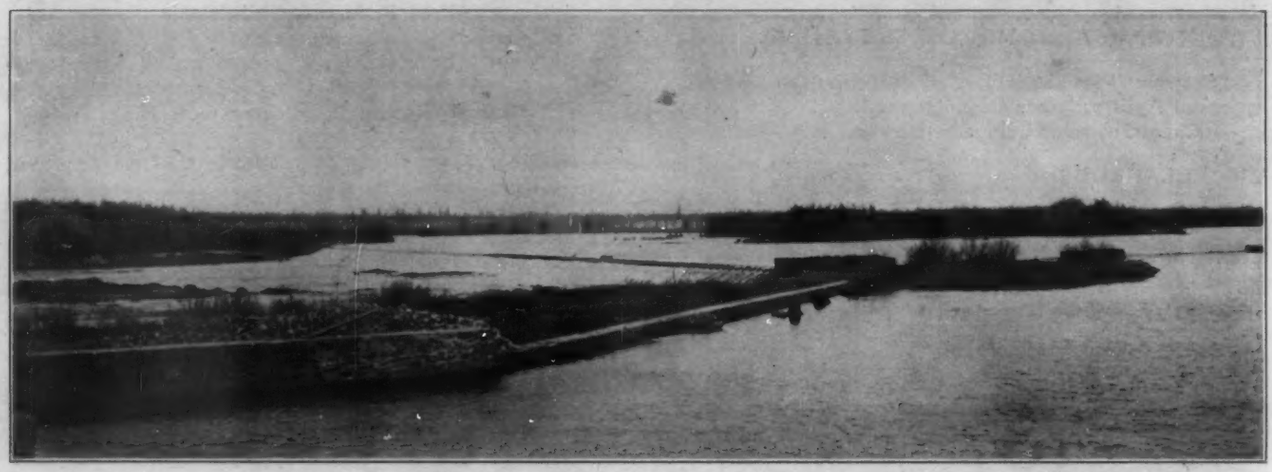
INDUSTRIAL

ELECTRICAL EQUIPMENT OF THE GRAND RAPIDS PULP AND PAPER COMPANY, GRAND RAPIDS, WISCONSIN.

The power requirements of pulp and paper mills present many problems arising from conditions peculiar to this class of industries. Continuity of service and uniform speed are essential to the successful manufacture of paper, as when a run is started it must be continuous and any lack of uniformity in speed seriously affects the quality of the product. The starting conditions of some of the machinery are severe and a large overload capacity in the motive power is therefore necessary.

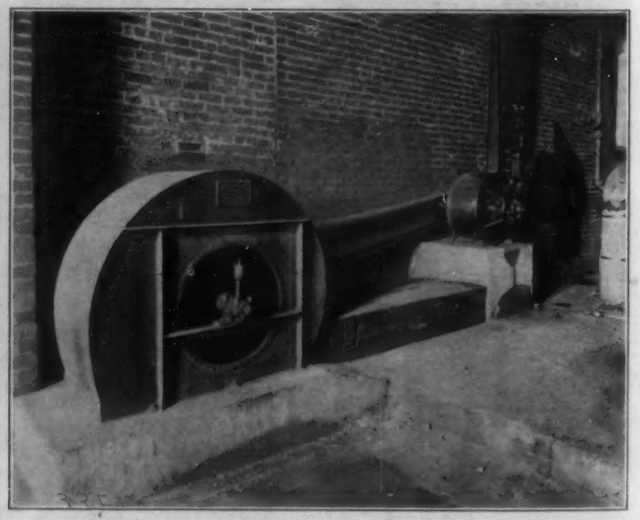
Electric motors have been found to fulfill all these requirements and have been adopted to a large extent by pulp and paper manufacturers. Many advantages are derived from their use that to a large extent eliminate the objectionable features of mechanical transmission. A flexibility is gained which permits the subdivision of units to such an extent that power may be delivered directly at the various points of application, thus eliminating the use of long lines of shafting and belting with their many attendant disadvantages, and the control of each section or individual machine is placed directly in the hands of the operative.

Another important feature is that portion of paper machines that operate at variable speeds, which includes the wire, press rolls, dryers and machine rollers. It is essential that the speed variations cover a considerable range, be easily controlled and complexity avoided as far as possible. In existing direct current plants or mills where it is deemed advisable to install direct current motors, the variable speed feature is taken care of by the use of variable speed motors, regulated by field control, which have a sufficient range to entirely eliminate the use of mechanical speed changing devices, which are necessary where mechanical transmission of power is used. This greatly simplifies the system and prevents the loss of power in overcoming the friction of belts and moving parts. The variable speed motor is easily controlled and has a definite known speed for each notch of the controller, which gives the operator an intelligent conception of the speed of his machine at all times. This is in great contrast to mechanical speed changing devices, which require



VIEW OF WISCONSIN RIVER SHOWING DAM

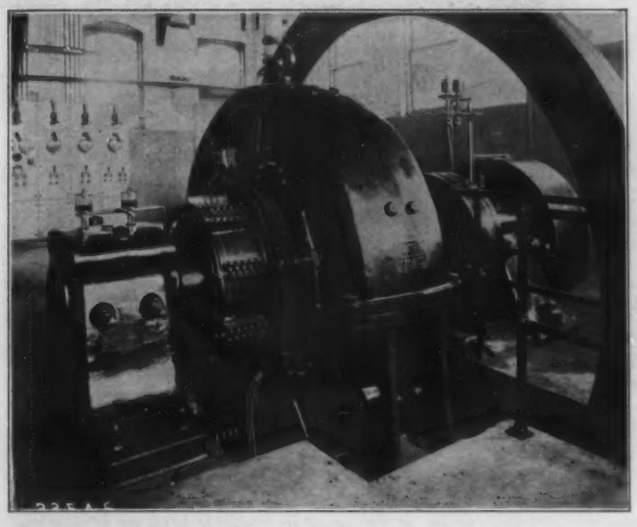
BOILER ROOM



BUFFALO FORGE CO.'S 54 IN. FAN DRIVEN BY A WESTINGHOUSE 10 H. P. TYPE S VARIABLE SPEED MOTOR

considerable manipulation to operate without any definite knowledge of intermediate speeds.

An illustration of the foregoing remarks is found in the plant of the Grand Rapids Pulp and Paper Company at Grand Rapids, Wisconsin. The mills are located on the Wisconsin River about four miles from the town, where an abundance of water power is available. This company strongly advo-



WESTINGHOUSE 200 K. W. 220 VOLT DIRECT CURRENT GENERATOR DRIVEN BY A 22 X 36 IN. CORLISS ENGINE

cates the use of electric drive and fully realizes the many advantages derived from its use. The electrical equipment was laid out by Mr. V. D. Simons, general manager of the company, and installed under his direct supervision. There are many mechanical and electrical features of interest and the entire installation is an example of modern engineering practice.

The pulp mill, where the stock is prepared for the manufacture of paper, is operated by water power, but the various processes afterward carried on employ electric drive.

One of the essential conditions of paper making is that as the weight or thickness changes the speed must be easily altered to provide for changes in the rate of production,

BEATER ROOM

which is usually accomplished by mechanical means. In the present case, however, the engineer accomplishes this result by the use of variable speed motors.

There are two Beloit paper machines, the smaller of the two having a capacity of 525 feet per minute, or a total of 21 tons per day, the width of the paper being 84 inches before and 78 inches after trimming. There are 29 dryers and a 70-foot wire. That portion of the machine which operates at variable speeds is driven by a 100 horsepower Westinghouse variable speed shunt wound motor with a speed vari-

NEW PULP MILL, SHOWING WATER WHEEL CONSTRUCTION IN FOREGROUND

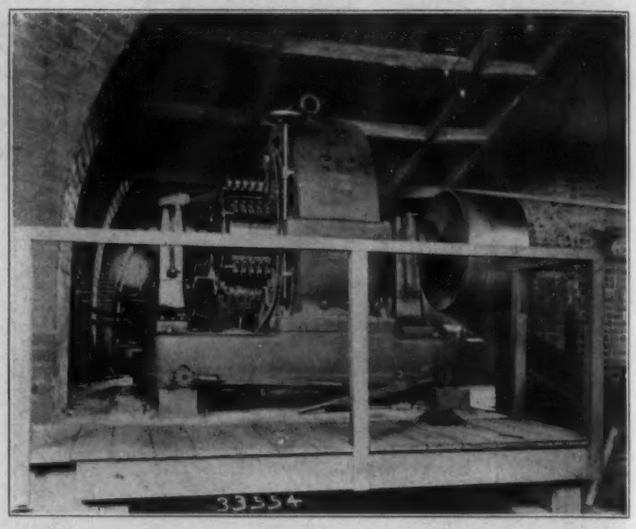
ation of 470 to 750 revolutions per minute, which is obtained by field control. The actual power required, as shown by tests, to drive the variable speed portion of the machine under normal working conditions, i. e., 525 feet per minute, is 101 horsepower. That portion of the machine which operates at constant speed is driven by a 50 horsepower Westinghouse type S motor.

The larger machine has a capacity of 26 tons of paper per day at the rate of 475 feet per minute, 104 inches wide before and 97 inches after trimming, and is provided with 25 dryers and a 60-foot wire. The variable speed portion is driven by a 100 horsepower Westinghouse direct current shunt wound motor with a speed variation ranging from 470 to 750

BELOIT PAPER MACHINE TURNING OUT 500 FT. OF 104 IN. PAPER PER MINUTE

revolutions per minute, obtained by field control. Actual power determined by tests to drive the variable speed is 97 horsepower. The constant speed portion is driven by a 50

BACK VIEW OF PAPER MACHINE SHOWING METHOD OF DRIVING FROM BENEATH THE FLOOR



WESTINGHOUSE 100 H. P. VARIABLE SPEED MOTOR OPERATING VARIABLE SPEED OF PAPER MACHINE

horsepower Westinghouse type S motor. The use of shunt-wound motors permits the use of field control which has the advantage of high efficiency and good regulation throughout its range.

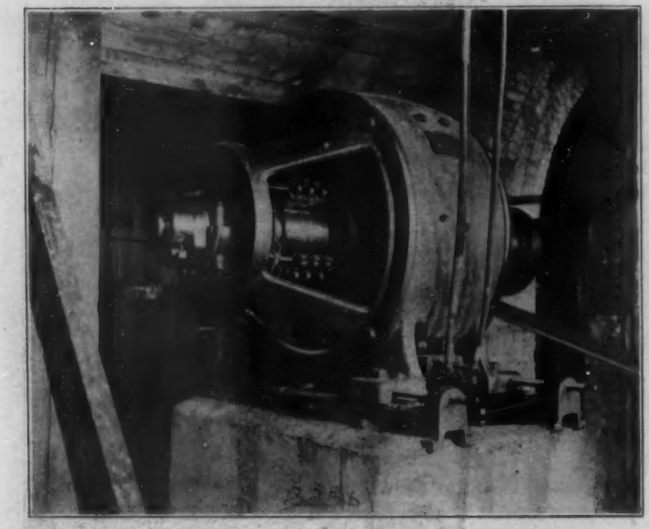
In the cutter room there are two cutters and an elevator operated by a 10 horsepower Westinghouse type S back-geared motor. An interesting feature in connection with this motor is that it replaced 250 feet of 3 7-16-inch line shaft.

A 10 horsepower Westinghouse, driving a fully equipped machine shop for general repair work completes the electrical equipment.

The present daily average output of this company is 45 tons of newspaper.

The boiler plant consists of four return tube units 72x16 inches, equipped with American underfeed stokers. The furnaces are the Dutch-oven type, arranged for burning refuse wood and screening coal. A 54-inch Buffalo Forge Company's fan, operated by a Westinghouse 10 horsepower type S variable speed motor, furnishes forced draft.

The generator equipment consists of one Westinghouse 200-kilowatt, 220-volt, engine type, direct current generator direct connected to a 22x36-inch Corliss engine operating at 125 revolutions per minute, and one Westinghouse 150-kilowatt generator of the same characteristic, belted through a countershaft to a water wheel. The rated speed of the generator is 600 revolutions per minute, and it operates in parallel with the engine-driven machine.



WESTINGHOUSE 50 H. P. TYPE S MOTOR OPERATING CONSTANT SPEED OF 104 IN. PAPER MACHINE

BELOIT PAPER MACHINE

An interesting feature in the regulation of the water wheel is the arrangement for controlling the gates. They are operated by a Westinghouse series wound reversible back-geared motor, started, stopped and reversed by means of a double push button on the switchboard. There is also an attachment on the governor of the engine for automatically controlling the motor, thus regulating the respective loads of the two generators.

The switchboard is of standard Westinghouse construction and consists of two generators and three feeder panels.

NEWS NOTES

TELEPHONES.

Farmers' Telephone Company has completed its line to the Badger Pocket country, 47 miles east of Ellensburg, west of Spokane. The line is 35 miles in length, and six trunk wires serve the subscribers.

The Interstate Telephone Company has just completed the installation of its system at Coeur d'Alene, Ida., east of Spokane, where its board has capacity for 500 lines, which will be doubled before the close of the year. J. W. Fisher is manager.

The Nez Perce Co-operative Telephone Company, operating at Ilo, Ida., south of Spokane, will improve its lines. The building of an extension from Dublin to Lawter's Canyon and the construction of a branch line from Nez Perce was authorized.

The Rocky Mountain Bell Telephone Company has granted increases to its operators at Wallace, Ida., east of Spokane. Beginners are paid at the rate of 10 cents an hour, and in three months this is raised to 16 cents. The new scale practically means an advance of $5 a month.

Members of the town council of Davenport, Wash., west of Spokane, unanimously voted down the application of John Nichols and others for a franchise for a second telephone system. The present system, known as the Farm and City Telephone Exchange, is controlled by J. A. Hansen, and is giving service all over Lincoln and Stevens Counties.

The government telephone line, paralleling the Sunnyside irrigation canal in the Yakima district, west of Spokane, has been completed. Eight patrol houses, for the use of riders, have been erected at 15-mile intervals, seven of these being equipped with instruments. From the head office at North Yakima lines will be built to each construction camp along the Tieton canal route.

Arrangements have been completed by the Pacific States Telephone Company for the installation of an automatic system to take the place of the town exchange at Pomeroy, south of Spokane. A new switchboard will be put in also, to better accommodate the increasing demand. The town exchange was installed in 1904, when 11 instruments were put in as an experiment. Now there are 200 instruments in use, besides the farmers' line, which utilizes 100 instruments.

Word has been received in Spokane that the government is making arrangements for the construction of a number of telephone lines in northwestern forest reserves. One of these will be in the Bitter Root reserve, in Idaho, east of Spokane, to the line running from Kootenai to the forks of the Clearwater River, 25 miles. The line will not only facilitate the work in the forests, but will play an important part in catching fires before they gain much headway.

Spokane, Wash.—Fifty thousand dollars will be expended by the Home Telephone Company of Spokane on a building to be used as a substation. The company will erect two substations and a main exchange, the entire cost being $200,000, exclusive of equipment. John T. Huetter, contractor, has begun work on the foundation for the main exchange, and the structure will be rushed. W. W. Hindman, attorney, who is associated with Cyrus Happy, vice-president of the company, announces that 4,000 instruments will be in operation Dec. 1, 1907.

TELEPHONE CONSTRUCTION.

Hoquiam, Wash.—Independent Tel. Co. began construction in this city May 20th.

Helena, Mont.—Western Union Tel. Co. has started work of placing wires underground.

Ferndale, Wash.—Farmers' Tel. Co. is setting poles to connect with Home Tel. Co. of Bellingham.

Hood River, Ore.—The Pacific States Tel. Co. will improve its system here with modern apparatus.

Portland, Ore.—Pacific Tel. & Telegraph Co. is laying new submarine cable under Willamette River at Washington Street.

Red Lodge, Mont.—Stillwater Co-operative Tel. Co. has completed 150 miles of rural line, and will build 80 miles additional.

Seattle, Wash.—U. S. Government will establish wireless telegraph station on Smith Island, opposite entrance to Straits of Juan de Fuca.

Butte, Mont.—Rocky Mountain Bell Tel. Co. is erecting a new building, 98x45 feet, to cost $85,000, to be finished August 1st; capacity, 11,500 subscribers.

Corvallis, Ore.—The Home Tel. Co. is constructing a trunk line from Corvallis to Peora. The line from Portland to Corvallis will be completed about June 15th.

Seattle, Wash.—N. P. Ry. Co. has been granted temporary injunction against the Home Tel. Co. from setting its poles on N. P. right of way. Hearing May 28th.

Monida, Mont.—Centennial Tel. Co. has let contract to Wm. Patt of this place for about 50 miles of line from Monida to Lakeview, to be completed September 1st.

Waitsburg, Wash.—Changing the lines of Waitsburg Rural Tel. Co. to offices of Pacific Tel. & Telegraph Co. is now going forward, the above named companies having consolidated.

Spokane, Wash.—Supervisor of Forest Service has been authorized to construct 25 miles of line from Kootenai to forks of Clearwater River, in Idaho, and from Parsons to Three Rivers, in New Mexico, 14 miles.

Bend, Ore.—Deschutes Tel. Co., of Bend, and State Central Tel. Co., of Prineville, will reorganize and consolidate with capital of $150,000. Lines will be constructed from Prineville to Burns, and Prineville to Silver Lake. New line from Prineville to Paulina is being pushed, about 40 miles being now completed.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

The 30th convention of the National Electric Light Association will be held June 4, 5, 6, 7, at Washington, D. C. The preliminary program gives promise of a most interesting and instructive meeting, including both social and business features. Technical papers are to be read by some of the best known engineers in the country.

POWER AND LIGHT PLANTS.

Lind, Wash.—H. Warner is negotiating for an electric light franchise.

Colfax, Wash.—Council will purchase two pumps and a gasoline engine for water plant.

Granite Falls, Wash.—A new wheel has been put in by the electric company which increases the power by about 50 horsepower

Georgetown, Wash.—Seattle Lighting Co. proposes to remove its gas plant from Jackson Street, Seattle, to this city if a franchise can be secured.

Oroville, Wash.—Col. A. M. Dewey, who is promoting an electric railway project for this territory, is building a power plant at Simikameen Falls.

Moscow, Ida.—The Idaho-Washington Light & Power Co., of Moscow, capital $500,000, succeeds the Moscow Light & Power Co. Company controls eleven plants in these two States.

North Yakima, Wash.—Work has commenced on the new building to be erected by the Northwest Light & Water Co., on Second and A Streets.

Tacoma, Wash.—A municipal light plant, to furnish 5,000 horsepower of electricity, and to cost $50,000, will be submitted to the Council and probably to the people.

Great Falls, Mont.—Two hundred feet of the steel trestle which supported the bar line from the power house to the electrolytic plant at the Boston and Montana smelter, collapsed.

Nelson, B. C.—The fight between the city of Nelson and the West Kootenay Power & Light Co., which has waged for seven years, has come to an end. The city will now supply its own light.

Lewiston, Ida.—The Oxbow Electric Co. is driving three tunnels across the oxbow of the Snake River and will install a plant to develop 2,500 horsepower for irrigation and power for mines.

Red Lodge, Mont.—The Northwestern Imp. Co., which is opening up extensive new coal mines near town, will install a second electric power house at the mine and add much new machinery.

Olympia, Wash.—The fight for the water right at Tumwater Falls has been decided by the Supreme Court in favor of the Olympia Light & Power Co., Leopold Schmidt losing the right to use the greater amount of the Des Chutes waters.

MEETING NOTICE

At a recent meeting of the Association of American Portland Cement Manufacturers, in Philadelphia, there was considerable discussion on the subject of concrete paving, the gist of which is published in Bulletin No. 14, including "Concrete Roadways," by H. L. Weber, and "Cement Concrete Roads," by Walter E. Hassam. Mr. Hassam's definition of a perfect road—a highway sanitary, durable, noiseless, dustless, smooth without being slippery, easy to repair and built at a cost that will appeal to the taxpayer—has been met by concrete. Stone and cement and the heavy roller have made it possible to build what is practically a highway of solid stone, a monolithic mass fully capable of resisting modern traffic for many years. Concrete Bridges are discussed in Bulletin No. 15.

TELEPHONE AND TELEGRAPH.

Ely, Nev.—E. H. Harrison, manager of the Utah and Nevada Telephone Company, a branch of the Rocky Mountain Bell Telephone Company, sends news that his company will begin immediately the construction of its proposed telephone line from Salt Lake to Ely. Contracts have been let for building the line in sections.

Greenville, Cal.—There is a movement among the stockmen of the Lassen Peaks Forest Reserve to secure the permission of the Federal Government to build connecting lines from the different camps of the stockmen to the line which the Government is going to establish through the reserve. Head Forester J. C. LaPlant has been consulted by many of the stockmen, and those of Payne's Creek have agreed to pay the cost of construction of a line if it can be arranged. It is the plan to build a connecting line through the Lassen Reserve to Red Bluff. The Government has planned to connect its phone line with Quincy and Susanville.

San Francisco, Cal.—The completed plans for the main building of the Home Telephone Company have been received. The structure will equal in architectural distinction any of the business houses in the locality. It will be of Class A construction, six stories in height, with basement. The type of the building is classic, and the order Corinthian, superimposed on a rusticated two-story base. The exterior will be of white sandstone. It is planned to complete the structure early in 1908, if labor conditions will permit. The site has a frontage of 63 feet on Grant Avenue and 130.5 on Harlan Place, an area between Bush and Sutter Streets. The officials of the Home Telephone Company report progress in the installation of their underground wire system, and expect to be ready to serve customers by the time the new building is completed.

Reno, Nev.—J. G. Blake, assistant general superintendent of the Postal Telegraph and Cable Company, was here recently after a trip to Ely, Tonopah, Goldfield and Bullfrog, where he has been looking over the proposed route of the Postal lines through Nevada to San Francisco. Mr. Blake has entire charge of the work in Nevada and was in Reno to consult with Engineer T. J. Stewart, who will supervise construction work in the State. Together they will prepare a report on the route chosen, to be submitted to Clarence Mackay and other officials of the company early in June. In speaking of the route, Mr. Blake said: "As near as we can tell now, the line coming from San Francisco will pass through Reno, and then into the Southern country, passing through Goldfield, Tonopah and Bullfrog to Ely, and from there to Salt Lake. Topography will determine the route, and the main line may pass a few miles outside of Reno, but our best offices will be installed here."

WATERWORKS.

Redding, Cal.—Six carloads of wooden pipe for water mains have been received from Tacoma. The pipe is for the enlarged system which the Redding Water Company has under construction—a system that will serve a part of the city not hitherto covered, and that will give a much better pressure throughout the city for fire purposes. The chief engineer predicts that the enlarged system will be completed by August 1. An entirely new pumping station is being built on the banks of the Sacramento River, a mile above the city. The excavation for the foundation is completed, and the cement foundations for the heavy pieces of machinery, pumps, motors and transformers, are being laid. The improvements to the waterworks will cost $60,000. Wooden mains, instead of iron mains, are being used in the western part of the city, because it has been found that there the sulphur carried in the soil waters attacks the metal and destroys the usefulness of the pipes. In other parts of Redding sulphur water does not appear, and there iron pipe gives satisfaction.

INCORPORATIONS.

San Luis Obispo, Cal.—The Lagunitas Oil Co. has been incorporated, with James Taylor, W. F. Summers, A. C. McMillan and others as directors.

Los Angeles, Cal.—The Norton Engine and Power Co. has been incorporated with a capital stock of $25,000. The incorporators include W. R. Harvey, T. S. and H. K. Norton.

Roswell, New Mex.—The Portales Water Works and Electric Light Co. has been incorporated here with Coe Howard, W. H. McDonald and Jos. Howard as incorporators. The company intends to operate waterworks and an electric light plant at Portales.

Los Angeles, Cal.—The Angelus Oil Co. has filed articles of incorporation with a capital stock of $300,000. Those behind the project are M. V. Quigg, J. O. Downing, C. F. Seaman, R. C. Smith and M. S. Gregory.

Los Angeles, Cal.—The Marine Power and Electric Co. has been incorporated here with a capital stock of $1,500,000. G. H. Bancroft, E. C. Phipps, G. M. Wilson, W. J. Compton and R. M. Amous, of this city, are the incorporators.

San Rafael, Cal.—Articles of incorporation have been filed by the Chapman Water Co., of Corte Madera. The capital stock is placed at $75,000, shares $1 each. The directors of the concern are M. C., E. C. and A. V. Chapman.

Visalia, Cal.—The Elderwood Water Company has been incorporated with a capital stock of $50,000, shares $50 each. Those backing the proposition are C. H. Holley, J. F. Mitchell, H. B. McClure, J. W. Fewel, J. E. Barton, H. G. Parish and William Cowling.

OIL.

Bakersfield, Cal.—The Southern Pacific is said to be making arrangements to extend its pipe line, which now ends at Delano, up the valley to San Francisco, as soon as possible. It is expected that work will be begun next Fall. The line will probably be of eight-inch pipe.

Bakersfield, Cal.—The local fuel oil market has received another upward boost in the form of an offer made to the McKittrick Oil Company for a five-year contract for 25,000 barrels a month at 50 cents per barrel. The oil already contracted for by the Associated leaves the McKittrick Company with little surplus oil. S. W. Wible, manager of the corporation, has made inquiries among the neighboring producers, with a view to making up the amount required, but some of the other companies are inclined to hold out for still higher prices. A number of new wells will be put down by the McKittrick Company as soon as practicable.

McMinnville, Ore.—A large company of capitalists of Portland and The Dalles have signed a lease for three thousand acres of land in the North Yamhill gap. The lease is for ninety-nine years and the operations are to begin at once to bore for oil. The contract reads for "oil, minerals and coal," and the owners are to get ten per cent of whatever is found. If oil is not struck in eighteen months the lease becomes null and void and reverts back to the owners of the land. The company is well backed financially and very expensive machinery will be installed at once. The company contemplates putting in $20,000 or $30,000 worth of machinery at the beginning. It has had experts in the country examining the formation here and they say that it is exactly the same as is found in rich oil regions and predict that oil will be found in the leased acres.

ELECTRIC RAILWAYS.

Bellingham, Wash.—The Bellingham-Skagit Co. Interurban is soon to commence work on its new road.

Clarkston, Wash.—Jay P. Graves announced that the Spokane & Inland Railway is going to build into this place.

Portland, Ore.—The Rainier Electric Co. has been incorporated with a capital of $25,000, by Alex Sweek, Carleton Lewis, and W. C. Morris. The company will build an electric line from here to Rainier.

Eugene, Ore.—The Eugene & Eastern Railway Co. has been incorporated with a capital of $1,000,000, by A. Welsh, E. W. Hall, F. W. Waters, James R. Thompson and Charles A. Hardy. It will build lines from here to Prineville, and also from here to Corvallis.

Milton, Ore.—The Walla Walla Valley Traction Co. has filed with the city the route of the proposed loop which is to be on First Street from Main to Mill; on Mill Street from First to Union; on Union Street from Mill to Cherry; on Cherry from Union to Thorn, and on Thorn Street from Cherry to Mill.

Roseburg, Ore.—Stock amounting to $100,000 has been subscribed for the Coos Bay Electric R. R.

Tacoma, Wash.—W. S. Dimmock states that work will soon commence on the new interurban from here to Orting.

Vancouver, Wash.—The Washington Railway & Power Co. will soon commence constructing their street railway in this city.

ILLUMINATION.

San Jose, Cal.—Among the merchants here there has been passed around a contract for lighting other than the system now in use. Hugh Center appears as the contracting party of the first part. He is at present in the East.

Suisun, Cal.—Attorney T. T. Gregory has appeared before the Board of Supervisors with an application from E. D. N. Lane, of Dixon, for a franchise to erect poles and string wires for transmitting electricity for lighting, heating and power purposes along certain roads leading from Dixon to Rio Vista, and along certain other roads in Silverville, Elmira and Green Valley townships, with the authority to sell and dispose of the electricity. The sale of the franchise has been set for June 3, and bids for the same will be received on that date.

Reno, Nev.—This city is trying to solve the problem of better and cheaper street lights. Arc lights supported on ornamental poles located every fifty feet along Virginia Street from the Truckee River Bridge to Commercial Row, will be installed if the present plans of City Electrician Caffrey are carried out. He says in his annual report that the work could be completed in such a manner as to add to the attractiveness of Virginia Street, and that the plan would be a great advertisement for the city. Twelve thousand sixteen-candlepower incandescent lights were installed in the stores, offices and homes of Reno during the last fiscal year, according to the report of the official.

Los Angeles, Cal.—Property owners on Pico Street have filed petitions with the City Clerk asking for ornamental lights on their street, something like the electroliers on Broadway and Spring Streets. They also ask that all the electric poles be taken down and ornamental poles substituted.

NEWS NOTE

Yreka, Cal.—J. F. Wagner has filed on 3,000 inches of water of Cabin Meadow Creek for mining and domestic use.

TRANSMISSION.

Nevada City, Cal.—The Bay Counties Power Co. has commenced the construction of a line which is to carry electric power from the Rome power house on the South Yuba River, near Hoyt's Crossing, to the Alaska Mine, near Pike City. The line will be ten miles in length, and about twenty-five men, under M. M. Turner, have been engaged to put the work through. The company wants to have the line completed in about two months. The Alaska is a rich mine, but the previous operation of it with steam power was so costly that the profits were very small. A tunnel will be run to drain the mine. The power line under construction will probably be extended to Alleghany and Forest, where there is great activity in the mining developments and need of cheaper power and lights.

Oakland, Cal.—The Western Power Company has located a site for a power station here, which is to be one of the main supply headquarters on a line stretching from the Sierras to the sea. The company has purchased a large tract of land in East Oakland on Brooklyn Basin, and here the plant will be constructed. The site is on what is known as Sessions Basin, just east of the north arm of the estuary into Lake Merritt and adjoining the holdings of the American Magnesite Co., at the foot of Sixth Avenue. The site has been selected for the main distributing point for Oakland. The company has extensive plans for the development of its main source of supply, which will be located in the Sierra Nevada Mountains, not far from where the main line of the Western Pacific crosses the mountains through the Beckwith Pass. The enterprise is closely identified with the Western Pacific interests in New York City. At the head of the new company are Edwin Hawley and other representative capitalists who are concerned directly with the Gould railway development. It is declared by those who are informed concerning the new company's movements in Oakland that the Western Power Co. proposes to compete with the Standard and Bay Counties Companies, and to extend and parallel one or both of those lines.

FINANCIAL.

Los Angeles, Cal.—The reorganization of the Pacific Lighting Corporation, of Los Angeles and Eureka, was effected last week by the filing of articles of incorporation by which the capital of the corporation is increased to $20,000,000, of which $10,000,000 is in preferred stock and the rest in common. In the new articles Alfred Sutro, C. O. G. Miller, George F. Voltman, Charles Holbrook and G. H. Collins are named as having subscribed for one $100 share each. Alfred Sutro says that the business of the company had increased to such an extent that it was thought advisable to enlarge its scope. Operations are not contemplated in San Francisco.

Los Angeles, Cal.—A new electric railway line connecting Santa Ana with Newport Bay, a city at the new tidewater to be called Port Orange, extensive terminal facilities and improvements contemplating connection with the three transcontinental lines, and the early opening of a free harbor, are a few of the things foreshadowed by the articles of incorporation of the Port Orange and Santa Ana Railway Co. The incorporators are Frank M. Johnson, Walter G. Hopkins, A. F. Lijeal, Joseph M. Fletcher, Eugene Germain, Mark L. Germain, C. L. Fredericks, Harry P. Vanderveer and G. H. McCarthy. The capital stock is $500,000, and the amount subscribed $50,000. The railroad will be a broad-gauge electric line, and will be the last link by rail between the sea and a population of 150,000, exclusive of Los Angeles, distributed among the cities of Southern California. The city of Santa Ana is to be the connection between all the cities of the southern part of the State and the harbor at Newport Bay. Nearly all the material for the new line has already been purchased, and work on construction will commence at once.

H. MUELLER MFG. CO.

Mueller Gas Tapping Machines are built with especial reference to

STRENGTH Where the Strain Comes

Ten different styles afford a wide range of adaptability to all classes of work.

Make Taps up to 4 inch. Unconditionally Guaranteed.

Write for prices and literature. Do it now.

H. Mueller Mfg. Co.
Decatur, Ill. New York City

The Spread of San Francisco in the

June Sunset

How the new City, under the impetus of rapid rebuilding, is moving south, filling the entire peninsula, being helped tremendously in suburban expansion by

The Bay Shore Railway Cut-off

A Great Issue

Eclipses the April "One Year After" Number

Send it to Your Eastern Friends

On Sale May 25th